Department of Geology Graduate Procedures and Policies

(draft 18 October 2022)

ADMISSION REQUIREMENTS

Admission to the Department of Geology graduate program at Stephen F. Austin State University is competitive and dependent on availability of departmental resources at the time of student application. In order for a prospective student to receive clear admission to the Department of Geology graduate program, they must meet the following requirements:

1. Minimum undergraduate grade point average of a 2.8 on a 4.0 scale.
2. Successful completion of the following classes:
   a. Physical Geology (GEOL 1303)
   b. Historical Geology (GEOL 1304)
   c. Mineralogy (GEOL 2341)
   d. Igneous and Metamorphic Petrology (GEOL 2342)
   e. Sedimentary Petrology (GEOL 2343)
   f. Stratigraphy (GEOL 4308)
   g. Structural Geology (GEOL 3338)
3. Successful completion of any three (3) upper-level geology courses, such as:
   a. Field Geology (GEOL 3664)
   b. Geochemistry (GEOL 4320)
   c. Geophysics (GEOL 4335)
   d. Hydrogeology (GEOL 4349)
   e. Invertebrate Paleontology (GEOL 3361)
4. Successful completion of the following additional courses:
   a. General Chemistry I (CHEM 1311)
   b. General Chemistry II (CHEM 1312)
   c. Calculus I (MATH 2413)
   d. Introduction to Probability and Statistics (MATH 1342)

If the applicant does not meet all of the above requirements, the applicant may be given probationary, provisional, or post-baccalaureate admission (see SFASU Graduate Bulletin for details) and may be required to take the courses needed to fulfil the requirements for admission into the Department of Geology graduate program. An applicant may be denied admission to the program because of weaknesses in their geologic background or availability of department resources.

GRADUATE ASSISTANTSHIPS

Graduate teaching and research assistantships will be awarded each semester as available on a competitive basis. Graduate students in good standing (i.e., students not on probation or provisional status) may apply for teaching and research assistantships. The following criteria will be considered for assistantships:

1. Graduate School Application
2. Undergraduate grade point average
3. Graduate grade point average
4. Three letters of recommendation
5. Personal letter of application
6. Effective oral and written communication skills

Fulfillment of graduate teaching and research assistantships require 20 hours/week of work. Teaching assistantship (TA) duties may include, but are not limited to, teaching undergraduate labs, assisting departmental field trips, maintaining regular office hours, and assisting in general departmental duties. Research assistantship (RA) duties will be assigned in accordance with objectives of the associated research project by the relevant graduate advisor—it is expected

that a student will spend more time on research than the hours of your RA contract because your research contributes to both your academic progress and your job responsibilities.

Teaching and research assistantships are subject to performance evaluation. Unsatisfactory performance by teaching and research assistants can result in employment termination at any time. Continuation of an assistantship will be assessed at the end of each long semester of employment. Graduate assistantships, once offered, are limited to four long semesters if acceptable employee performance is maintained.

Operation of University Vehicles

Teaching and research assistants with a valid Driver License are required to obtain a valid Texas Driver License within 90 days of employment at SFASU and subsequent University Driving Certification. Graduate students who do not obtain a valid Texas Driver License within the first semester of employment are not eligible to have their assistantships renewed for a second semester. University Driving Certification will be scheduled through the departmental administrative assistant after a Texas Driver License has been obtained.

Teaching and research assistants may be required to drive university vehicles, including multi-passenger vans, for departmental field trips, conferences and/or research projects. Specific driving requirements will vary depending on departmental needs and student driving experience; graduate assistants must demonstrate at least one year of driving experience. Driving proficiency will be assessed by the department to determine driving assignments.

Graduate students cannot operate any university vehicles for any reason without a valid Texas Driver License and University Driving Certification as per regulation of State of Texas regarding state property. Any individual riding in a university vehicle must be a student or university employee of SFASU.

GENERAL GRADUATE STUDENT REQUIREMENTS

Graduate Geology Exams

Incoming graduate students are required to complete a Graduate Geology Entrance Exam during the first month enrolled within the Geology graduate program. This exam will test the breadth of their knowledge across a spectrum of geoscience topics and help determine any areas of weakness in order to properly advise students.

Graduate students are required to complete a Graduate Geology Exit Exam in the fourth long semester of their graduate studies. This exam will assess graduate learning and development of geoscience skills as a graduate student and should show improvement from the Graduate Geology Entrance Exam completed in their first semester. The Graduate Geology Entrance and Exit exams are written by Department of Geology faculty and may be rewritten or modified by the faculty at any time.

Graduate Geology Entrance and Exit exams will cover the following topic areas:

1. Economic Geology
2. Geophysics
3. Geochemistry
4. Hydrogeology
5. Mineralogy and Petrology
6. Physical Geology
7. Stratigraphy and Sedimentology
8. Structural Geology

Students will be informed electronically of their performance on exams.

Graduate Geology Activities

Graduate students in the Department of Geology are expected to be actively involved in departmental activities. All graduate students are specifically required to:

1. Attend Department of Geology graduate thesis defenses;
2. Attend Department of Geology colloquia and professional presentations;
3. Participate in special programs offered by the Department of Geology as requested by faculty of the Department of Geology (e.g., Earth Science Week); and
4. Participate in Department of Geology outreach and recruitment programs (e.g., STEM Day, Showcase Saturday)

GRADUATE PROGRAM OPTIONS

Students wishing to pursue a Master of Science (M.S.) in geology must select either a thesis (Option 1, see below) or non-thesis (Option 2, see below) program track, with degrees consisting of a minimum of 30 or 36 credit hours of coursework, respectively. Thesis and non-thesis degrees are tailored to meet the academic and career goals of individual students. Graduate research opportunities are offered in geoscience disciplines within which graduate faculty within the Department of Geology conduct research. If students wish to pursue a minor or minors, they may select courses from other departments following the guidelines established elsewhere in the SFASU Graduate Bulletin.

Graduate students are required to establish a graduate research advisor from the Department of Geology who has geoscience research interests that overlap those of the student and is available for graduate student advising (i.e., some graduate advisors may not be able to mentor new graduate students at any given time because of obligations to other graduate students they are currently advising). The research advisor will mentor each graduate student through their graduate studies.

Option 1 (thesis track program) is a traditional graduate degree that is recommended for students who plan to enter careers in which employers require significant independent research and scientific writing or students who plan to continue their academic studies beyond the M.S. level. Option 1 includes fewer course requirements to enable students to dedicate extensive time to thesis research and prepare a thesis manuscript that incorporates in-depth analyses and evaluation of complex geoscience topics. Thesis research is: 1) designed to evaluate geoscience phenomena in detail; 2) conducted and synthesized over several academic semesters; and 3) structured to enhance the understanding of studied phenomena through dissemination to the geoscientific community. In consultation with the graduate research advisor, students pursuing the thesis track program will form a graduate thesis committee to provide recommendations and guidance during the student's graduate studies and research.

Option 2 (non-thesis track program) is a graduate degree that is recommended for students who are primarily interested in obtaining a graduate degree for career advancement within a geoscientific field. Option 2 requires more coursework coupled with a technical report that characterizes a limited focus research topic, but does not include in-depth analysis of research findings. Non-thesis research is: 1) designed to collect and process geologic data; 2) generally conducted within one academic semester; and 3) structured to develop professional communication skills.

Option 1: Thesis Track (Master of Science Degree With Thesis)

The **Master of Science Degree With Thesis** (Option 1) consists of a minimum of 30 hours of graduate coursework, including at least: 18 hours of graduate geology coursework; three hours of thesis research (GEOL 5389) and three hours of thesis writing (GEOL 5390). Six hours of additional coursework as approved by the graduate committee may include coursework from other university programs. Students who plan to continue their graduate work beyond the

master's degree, or who plan to enter careers involving geoscience research or scientific writing are encouraged to select Option 1

Graduate students who elect Option 1 (Thesis Track) are required to have a thesis advisor from the graduate faculty of the Department of Geology. The thesis committee consists of a minimum of four members, including the thesis advisor, with a majority of the thesis committee from the faculty of the Department of Geology. At least one thesis committee member must be a graduate faculty member outside of the Department of Geology at SFASU. Members of the thesis committee will be selected by the student in consultation with the faculty research advisor.

Under limited, extenuating circumstances (e.g., death, extended hospitalization, retirement, etc.), a graduate student may change their thesis research advisor or any thesis committee member after the thesis proposal has been submitted to the Graduate School (see Thesis Proposal section below). If a thesis advisor or committee member is changed, the student will be required to file a Change of Thesis Committee application to the Graduate School before they can proceed with a Thesis Defense (see Thesis Defense section below).

In order for a graduate student to complete Option 1 (Thesis Track) within two years, the student is expected to successfully complete the following (additional coursework may be required in a semester to meet university and college requirements for graduate assistantships or financial aid):

1. 1st Long Semester
   a. 9 hours of graduate coursework;
   b. Department of Geology Graduate Entrance Exam; and
   c. Establish thesis advisor and thesis research topic.
2. 2nd Long Semester
   a. 6 hours of graduate coursework;
   b. Form thesis committee; and
   c. Committee approved thesis proposal.
3. Summer Session
   a. 3 hours of graduate coursework; and
   b. Conduct thesis research.
4. 3rd Long Semester
   a. 6 hours of graduate coursework (including 3 hours of GEOL 5389);
   b. Process and analyze thesis research data; and
   c. Present research findings in the Department of Geology Colloquium.
5. 4th Long Semester
   a. 6 hours of graduate coursework (including 3 hours of GEOL 5390);
   b. Department of Geology Graduate Exit Exam;
   c. Complete thesis and conduct a thesis committee meeting to determine if thesis is defendable;
   d. defend thesis; and
   e. Submit committee-approved thesis to the SFASU Graduate School.

Thesis Proposal

Graduate students are required to write a thesis proposal following the guidelines of the Graduate School. The proposal must be signed by their graduate advisor, thesis committee members, the chair of the Department of Geology and the Dean of the Graduate School. A copy of this proposal will be retained by the student, thesis advisor and Department of Geology.

At a minimum, a thesis proposal should include the following components:

1. Identification of objectives, goals and/or hypotheses for the proposed research;
2. Description of proposed research area, location, and/or boundaries (physical or theoretical) of research;
3. Detailed literature review of material relevant to proposed research (e.g., geologic history, geologic setting, relevant case studies, etc.);
4. Proposed methodology for achieving research;
5. Budget analysis of expected cost to complete proposed research; and
6. Timeline of project stages leading to completion of thesis.

Thesis students will present their thesis proposal to their committee for review prior to thesis committee approval. The committee will evaluate both the written thesis proposal and a brief oral presentation of the proposed research by the student in order to ensure that proposed research is well designed and can be completed in a timely manner. The approved thesis proposal will be submitted to the Department of Geology and the SFASU Graduate School, which officially forms the thesis committee.

If a graduate student changes their thesis research topic after they have filed a thesis proposal with the Graduate School, the student must dissolve their original thesis committee, form a new thesis committee, and submit a new thesis proposal that reflects the new thesis research topic.

Thesis Manuscript Preparation

Thesis manuscripts must be prepared according to the SFASU Graduate School guidelines. Contents of the thesis manuscript are determined in consultation with the thesis research advisor and thesis committee members. For complete guidelines on how to prepare the thesis, please refer to the SFASU Graduate School Policies and Procedures for Current Students.

Theses vary significantly in format and content based on research discipline, as well as the academic and professional audience to which the research will be distributed. The thesis content will be prepared through collaboration between the graduate student, their thesis advisor, and their thesis committee. Theses may be prepared as traditional thesis manuscripts that parallel the format of the thesis proposal or as publication-style manuscripts prepared for submission to a peer-reviewed journal.

In the long semester that the student plans to graduate, the student must:

1. Submit an advisor-approved draft of the thesis to all thesis committee members no later than the 9th academic week of a long semester;
2. Conduct a thesis committee meeting to determine if the thesis is defendable no later than the 10th academic week of a long semester;
3. Submit a thesis draft to the SFASU Graduate School for verification that the document is mechanically correct within the guidelines of SFASU no later than the 11th academic week of a long semester;
4. Submit a defendable thesis draft to the thesis committee no later than the 11th academic week of a long semester;
5. Schedule and publicly announce a thesis defense through digital media and Department of Geology postings no later than the 11th academic week of a long semester; and
6. Successfully defend thesis work no later than the 13th academic week of a long semester.

The committee-approved thesis draft will serve as the basis for the thesis examination/defense. The thesis draft must meet the following requirements:

1. Be complete in all aspects;

2. Be mechanically correct (see items under Final Manuscript Preparation in the Graduate School Thesis Guide);
3. Include all figures, plates, and tables in final form; and
4. Be approved for content by all members of the thesis advisory committee.

Thesis Defense

The Application for Thesis Examination form may only be submitted after the defendable thesis draft is submitted to and approved by the SFASU Graduate School. The thesis draft will be reviewed by the SFASU Graduate School for formatting consistent with university guidelines. This form must be filed as specified by the SFASU Graduate School in any given semester (see the SFASU Graduate School for specific dates).

A thesis defense will include:

1. A public oral presentation of the student's work to faculty, students and other interested individuals;
2. Questions from the audience following the oral presentation;
3. A private session during which the student will be questioned by thesis committee members to determine if the thesis and thesis defense are acceptable; and
4. A thesis committee discussion and vote on whether the thesis and thesis defense are acceptable. The thesis student will not be present for the committee discussion and vote. Acceptability is determined by a majority vote of the thesis committee members.

If the thesis defense is voted acceptable by the thesis committee, then:

1. The graduate student will make thesis corrections as determined by the thesis advisor and thesis committee.
2. The committee members will review the thesis after corrections are completed, and if approved, will sign the final thesis forms.

If a thesis defense is voted not acceptable, the student will be given a list of changes and corrections that must be addressed. The student will be given a second and final attempt to defend the thesis the following long semester. If the student fails the second attempt, the student will not be allowed to continue in the Thesis Option of Department of Geology graduate program. Students that fail the second thesis defense may elect to switch to the Non-Thesis degree option within the Geology graduate program and will be required to complete all requirements for the Non-Thesis degree option.

Completion of Thesis Track Degree Requirements

Graduate students pursuing Option 1 (Master of Science Degree With Thesis) will have fulfilled the requirements of the Department of Geology and the SFASU Graduate School when the following tasks have been successfully completed:

1. Completion of 30 hours of graduate coursework including at least 18 hours of graduate geology courses, three hours of graduate research (GEOL 5389) and three hours of thesis writing (GEOL 5390);
2. Public presentation of thesis research in a Department of Geology Colloquium;
3. Oral defense with approval from a majority of the thesis committee;
4. Completion of a thesis that is technically accurate, formatted in accordance with Graduate School guidelines and approved by the thesis committee, the Chair of the Department of Geology and the Dean of the Graduate School; and
5. Submission of final approved thesis, including digital submission to SFA Scholarworks and at a minimum one hard copy to the East Texas Research Center (ETRC) at the Ralph Steen Library.

Option 2: Non-Thesis Track (Master of Science Degree Without Thesis)

The Master of Science Degree Without Thesis (Option 2) consists of a minimum of 36 hours of graduate coursework, including at least 30 hours of graduate geology coursework. Six hours of additional coursework as approved by the Department of Geology graduate faculty may include coursework from other university programs. Graduate students who elect Option 2 (Non-Thesis Track) are required to complete a graduate research project and associated coursework based on the recommendations of a graduate academic advisor. The non-thesis student is required to successfully complete an oral examination in their final semester of scheduled coursework to demonstrate mastery of geologic concepts. Graduate students are expected to establish a graduate academic advisor by the end of the first long semester that the student is enrolled at SFASU.

In order for a graduate student to complete Option 2 (Non-Thesis Track) within two years, the student is expected to successfully complete the following:

1. 1st Long Semester
   a. 9 hours of graduate coursework;
   b. Establish graduate academic advisor;
   c. Department of Geology Graduate Entrance Exam.
2. 2nd Long Semester
   a. 9 hours of graduate coursework;
3. Summer Session between long semesters
   a. 6 hours of graduate coursework.
4. 3rd Long Semester
   a. 6 hours of graduate coursework, including 3 hours of Graduate Research (GEOL 5388).
5. 4th Long Semester
   a. 6 hours of graduate coursework;
   b. Department of Geology Graduate Exit Exam;
   c. Pass an oral examination based on coursework completed during graduate studies.

Graduate Research Project

Graduate students pursuing a Master of Science Degree Without Thesis (Non-Thesis Track) are required to successfully complete 3 hours of Graduate Research (GEOL 5388), a semester-long research project directed by a graduate research advisor. It is recommended that the graduate research advisor be the same geology faculty member as the graduate academic advisor in order to better prepare the Non-Thesis Track student for their graduate research project.

The requirements and objectives of the graduate research project will be established by the graduate research advisor in conjunction with the geoscience interests of the graduate student. At a minimum, the non-thesis graduate research project will include:

- Identification of the objective, goal and/or hypothesis of the research project;
- Review of applicable literature relevant to the research project;
- Development of appropriate methodology for achieving proposed project;
- Collection of appropriate data for achieving proposed project;
- Compilation of geoscience technical report based on findings of proposed project.

A geoscience technical report is a document that provides data and limited analyses of geoscience phenomena under investigation generally as part of preliminary or limited research. Technical reports may include general conclusions of research findings but more often provide recommendations for future studies. Unlike a thesis manuscript, technical reports do not provide a detailed synthesis of data, nor do they provide substantive conclusions to explain the occurrence of geologic phenomena.

Technical reports vary significantly in format and content based on research discipline as well as the professional audience for which a report is intended. At a minimum, technical reports identify the goal or objective of the study, provide data collected in the study, and discuss the data accuracy limits with regard to sources and methodologies employed. Technical reports are internal documents primarily constructed for sponsors of research projects, not manuscripts prepared for public dissemination in peer-reviewed journals. As a non-thesis graduate student, your technical report will be prepared for your graduate research advisor as the major requirement of Graduate Research (GEOL 5388).

Oral Examination

During the final semester of scheduled coursework, the non-thesis student will be administered an oral exam. The oral exam cannot be scheduled prior to completion of Graduate Research (GEOL 5388) and must be scheduled no later than the 13th academic week of a long semester.

A non-thesis oral exam committee will consist of the graduate academic advisor and three additional geology faculty assigned by the Department of Geology based on coursework completed by the student. The oral examination will evaluate higher-level critical thinking skills and in-depth knowledge of geoscience principles in order to demonstrate mastery of geologic concepts. Oral examination topics from individual committee members will focus on specific graduate coursework the student successfully completed throughout their graduate studies. Oral examination questions will be prepared by oral exam committee members prior to the exam. Oral questions cannot be modified or added to by exam committee members during the oral examination.

If the non-thesis oral examination is voted acceptable by a majority of the non-thesis committee members, the non-thesis student will have demonstrated mastery of geologic concepts.

If the non-thesis oral examination is voted not acceptable by a majority of the non-thesis committee members, the student will be allowed to prepare for a second and final oral examination the following long semester. If the non-thesis student does not meet acceptable standards by demonstrating mastery of geologic concepts in their second attempt, they will not be allowed to continue in the Department of Geology graduate program.

Completion of Non-Thesis Track Degree Requirements

Graduate students pursuing Option 2 (Master of Science Degree Without Thesis) will have fulfilled the requirements of the Department of Geology and the SFASU Graduate School when the following tasks have been successfully completed:

1. 36 hours of graduate coursework including at least 30 hours of graduate geology courses;
2. Successful completion of Graduate Research (GEOL 5388); and
3. Oral examination with approval from a majority of the non-thesis oral exam committee.

GRADUATE FACULTY RESPONSIBILITIES

Graduate faculty within the Department of Geology are dedicated to the success of graduate students within the program. As graduate advisors and committee members, faculty have specific responsibilities to students, including advising and research guidance. Students should schedule regular meetings with research advisors and committee members to ensure timely progress towards a graduate degree. Effective communication between the research advisor and committee members is crucial for successful completion of graduate studies.

Academic Advising: the research advisor (see below) is responsible for assisting with development of the student's academic program of study and provides primary guidance on coursework applicable to customized degree plans. The graduate research committee should provide additional recommendations of coursework that will facilitate the research project, but ultimately the graduate degree plan is developed through consultation with the graduate research advisor. At a minimum, the student should meet with the research advisor at least once a semester to discuss academic progress. If a student does not have a research advisor prior to the first semester of enrollment within the Department of Geology graduate program, the departmental graduate advisor is responsible for providing academic guidance until the student has established a research advisor.

Research Advisor: the research advisor supervises graduate student work and chairs the associated graduate research (thesis or project) committee—the research advisor is the primary mentor throughout graduate studies. The research advisor will assist in developing a research topic, defining the limits and applicable methods for achieving and investigating the research goals, and guiding the research project to completion. The research advisor will provide guidance for presentations, both oral and poster, and is responsible for helping the graduate student develop critical thinking skills as well as professional communication skills, both written and oral. The research advisor is expected to provide reviews of graduate student work within a timely manner during long academic semesters. A normal response time for review of written documents is less than two weeks; however, longer delays may occur during breaks between long semesters, including summer, when the research advisor may have other commitments away from campus, including personal research.

Different research advisors have different approaches to research and associated expectations; therefore, it is imperative that students maintain communication with research advisors throughout graduate studies. Students should maintain an open dialogue with research advisors and clearly understand the expectations a research advisor has for student research responsibilities and progress goals. The student should respond to questions and correspondence from the research advisor in a prompt manner, as faculty are expected to do the same for students. Clear communication with the research advisor and achievement of research and academic expectations are critical for graduate student success.

Committee Members: the committee members are responsible for providing guidance and support throughout graduate research and serve as a professional review committee of student communication skills, both written and oral. Committee members are expected to review advisor-approved written materials associated with graduate research and provide suggestions for improvement. It is expected that committee members will provide constructive feedback on research projects in a timely manner (i.e., within two weeks of receipt of written materials within a long semester) in accordance with professional research expectations. Ultimately, it is the responsibility of the research advisor to ensure that recommendations from committee members be incorporated into graduate research products; committee members serve as an advisory group for student research.

GRADUATE COURSES IN GEOLOGY

Graduate geology courses at SFASU are offered in a wide variety of topics. Most courses are offered on a standard two-year rotation so that students can develop an appropriate academic schedule in consultation with their research advisors. The scheduled rotation of geology graduate courses is provided below, followed by a description of geology graduate courses offered at SFASU.

Fall of Even Numbered Calendar Years

- **GEOL 5306** (Sequence Stratigraphy)
- **GEOL 5317** (Regional Tectonics)
- **GEOL 5332** (Petroleum Geology and Fossil Fuels)
- **GEOL 5335** (Non-Seismic Methods)
- **GEOL 5345** (Geochronology)
- **GEOL 5359** (Contaminant Hydrology)

Spring of Odd Numbered Calendar Years

- **GEOL 5315** (Sedimentary Petrology)
- **GEOL 5319** (Advanced Petroleum Geology)
- **GEOL 5334** (Petroleum Basin Evaluation)
- **GEOL 5340** (Metamorphic Basement Geology)
- **GEOL 5341** (Geocharacterization of Natural Resources)

Summer of Odd Numbered Calendar Years

- **GEOL 5309** (Carbonate Depositional Systems)
- **GEOL 5342** (Exploration of Ore Resources)

Fall of Odd Numbered Calendar Years

- **GEOL 5308** (Clastic Depositional Systems)
- **GEOL 5318** (Advanced Structure)
- **GEOL 5332** (Petroleum Geology and Fossil Fuels)
- **GEOL 5336** (Seismic Methods)
- **GEOL 5338** (Petrophysics)
- **GEOL 5349** (Applied Hydrogeology)

Spring of Even Numbered Calendar Years

- **GEOL 5307** (Sedimentology)
- **GEOL 5323** (Aqueous Geochemistry)
- **GEOL 5333** (Petroleum Exploration Techniques)
- **GEOL 5334** (Petroleum Basin Evaluation)
- **GEOL 5344** (Geoanalytical Methods)

Summer of Even Numbered Calendar Years

- **GEOL 5320** (Geochemical Environments)
- **GEOL 5350** (Cave and Karst Systems)

Graduate Geology Course Descriptions

- **GEOL 5305 - Stratigraphy of North America** *(scheduled as needed)*: study of the stratigraphy, tectonics and paleontology of North America during the Precambrian and Phanerozoic Eons as it relates to the development and evolution of the North American Plate.
- **GEOL 5306 - Sequence Stratigraphy** *(scheduled fall semesters of even numbered calendar years)*: A study of sequence stratigraphy and sequence stratigraphic relationships and the identification, origin, distribution and correlation of sedimentary cycles.
- **GEOL 5307 – Sedimentology** *(scheduled spring semesters of even numbered calendar years)*: Study of sediments and sedimentary processes. Co-requisite lab (GOL 5007) required.
- **GEOL 5308 - Clastic Depositional Systems** *(scheduled fall semesters of odd numbered calendar years)*: Clastic depositional systems investigates the environments associated with clastic and volcanoclastic sediments, as well as the subsequent diagenesis of these rocks.
- **GEOL 5309 - Carbonate Depositional Systems** *(scheduled summer semesters of odd numbered calendar years)*: Carbonate depositional systems investigates the environments associated with carbonate and evaporite deposition, as well as the subsequent diagenesis of these rocks.
- **GEOL 5315 - Sedimentary Petrography** *(scheduled spring semesters of odd numbered calendar years)*: Principles of research design and development, including utilization of available resources and effective writing skills; experimental design is emphasized throughout the course; development of thesis proposal, grant proposals and professional résumés. Should be taken within the first two semesters of enrollment. Co-requisite lab (GEOL 5015) required.
- **GEOL 5317 - Regional Tectonics** *(scheduled fall semesters of even numbered calendar years)*: Advanced topics in regional tectonics, the study of structural deformation on a regional-to-global scale. Discussion of plate tectonics theory and examination of tectonic processes at plate boundaries and intraplate areas. Models of regional deformation will be compared to real-world examples by in-depth analysis of the geology of one or more areas.
- **GEOL 5318 - Advanced Structural Geology** *(scheduled fall semesters of odd numbered calendar years)*: Integrated study of geologic structures and behavior of materials.
- **GEOL 5319 - Advanced Petroleum Geology** *(scheduled spring semesters of odd numbered calendar years)*: Modern advancements in oil and gas exploration and production, including petrophysical logs, depositional facies, hydrocarbon maturation, seismic interpretation and economic analyses. Co-requisite lab (GEOL 5019) required.
- **GEOL 5320 - Geochemical Environments** *(scheduled summer semesters of even numbered calendar years)*: Application of fundamental chemical concepts to geochemical environments. Quantitative techniques are employed to solve problems involving geological materials.
- **GEOL 5323 - Aqueous Geochemistry** *(scheduled spring semesters of even numbered calendar years)*: An in-depth investigation into chemical reactions that occur in natural waters, including detailed descriptions of thermodynamic and kinetic modeling, chemical speciation, mineral dissolution/precipitation, and redox cycling.
- **GEOL 5332 - Petroleum Geology and Fossil Fuels** *(scheduled fall semesters)*: An introduction to fossil fuels with an emphasis on hydrocarbon generation and exploration techniques. Topics will include properties of hydrocarbons; preservation conditions and migration pathways; source rocks, reservoir rocks and trapping mechanisms; common exploration techniques, such as wireline logging and seismic interpretation; and an overview on the preservation and exploration of other fossil fuels, such as coal,

unconventional hydrocarbons, tar sands and methane clathrates. Co-requisite lab (GEOL 5332L) required.

- **GEOL 5333 - Petroleum Exploration Techniques** *(scheduled spring semesters of even numbered calendar years)*: An introduction to petroleum exploration techniques commonly used in the field. Course will mostly focus on wireline logging, although some time will be spent on cores and correlating information between multiple sources and seismic interpretation.
- **GEOL 5334 - Petroleum Basin Evaluation** *(scheduled spring semesters)*: This course is designed to teach techniques used to evaluate petroleum basins. Students enrolled in this course are expected to compete in the annual Association of American Petroleum Geologists Imperial Barrel Award competition. The IBA is an annual prospective basin evaluation competition for geoscience graduate students from universities throughout the world. University teams compete to win scholarship funds for their geoscience department and the international recognition that comes from competing in and/or winning the competition.
- **GEOL 5335 - Non-Seismic Methods** *(scheduled fall semesters of even numbered calendar years)*: This course is designed to teach students to collect and interpret non-seismic data that will help solve problems in the environmental, petroleum, mining and engineering fields. Lectures will cover theory, instrumentation and interpretation techniques for various geophysical methods. Labs will emphasize the processing and analyses of real or simulated data sets. Processed data will form the basis of a term project. Co-requisite lab (GOL 5035) required.
- **GEOL 5336 - Seismic Methods** *(scheduled fall semesters of odd numbered calendar years)*: This course is a survey of the application of seismic methods to hydrocarbon exploration, investigations of the lithosphere and environmental investigations of the shallow subsurface. Topics include physical principles of seismic wave propagation and acquisition, processing, and interpretation of seismic reflection, and refraction data. Co-requisite lab (GEOL 5036) required.
- **GEOL 5337 - Earthquake Seismology** *(scheduled as needed)*: Concentration on introductory theories of earthquake seismology, interpretation of seismic data and its application in geophysics and engineering. The course also will prepare students of seismology for further study of earthquakes and Earth structure using seismograms while providing an overview of earthquake seismology for non-seismologists. Introductory mathematical seismology (stress-strain, reflection coefficients, ray theory, earthquake location, etc.), also will be reviewed. Some computer experience will be required for assignments.
- **GEOL 5338 - Petrophysics** *(scheduled fall semesters of odd numbered calendar years)*: An introduction to the fundamentals of petrophysics and wireline logging. This course emphasizes determining the physical and chemical properties of rocks and their contained fluids in the subsurface. Properties will be determined using a combination of wireline logs, core, and physical measurements within a borehole.
- **GEOL 5340 - Metamorphic Basement Geology** *(scheduled spring semesters of odd numbered calendar years)*: This course explores geologic processes that affect the middle and lower crust, modern analytic techniques applied to the study of basement processes, and connections between basement geodynamics and surface/near-surface processes.
- **GEOL 5341 - Geocharacterization of Natural Resources** *(scheduled spring semesters of odd numbered calendar years)*: This course is designed to provide an overview of the application of spatial analyses and remote sensing methods utilized in natural resource characterization. Emphasis will be on mineral resources, coastal processes, water resources, soils, land use and environmental evaluation.
- **GEOL 5342 - Exploration of Ore Resources** *(scheduled summer semesters of odd numbered calendar years)*: This course provides an overview of the geology of economic

mineral systems formed by magmatic-hydrothermal, sedimentary and metamorphic processes. An emphasis will be on the natural controls on mineral resource localization, transportation mechanisms for metals and sulfur in the environment, and resource extraction. Students will be expected to research the physical and chemical characteristics of selected deposits and mining districts, including tectonic settings, geochemical investigations, and application of new developments in spatial characterization and remote sensing methods.

- **GEOL 5344 – Geoanalytical Methods** *(scheduled spring semesters of even numbered calendar years):* The application of common geoanalytical methods to geologic materials (minerals, rocks, engineering samples), and approaches to accurate and effective data analysis and communication. Prerequisite: Graduate standing.
- **GEOL 5345 – Geochronology** *(scheduled fall semesters of even numbered calendar years)*: The principles and practical applications of using radiogenic isotope systems to determine the timing of geologic events and the rates of geologic processes.
- **GEOL 5349 - Applied Hydrogeology** *(scheduled fall semesters of odd numbered calendar years)*: Principles of water movement through the unsaturated and saturated zones with emphasis placed on quantifying the rate and method of movement.
- **GEOL 5350 - Cave and Karst Systems** *(scheduled summer semesters of even numbered calendar years)*: This course will explore the underground world of caves as students are introduced to the complexities of karst systems, including the geologic and hydrologic controls on porosity evolution in soluble rocks. Students will learn characteristics and behavior of fluid flow through multi-permeability systems as it applies to karst aquifers and mineral deposits. Students will be introduced to the unique environmental and engineering concerns associated with karst terrains and groundwater resources.
- **GEOL 5359 - Contaminant Hydrology** *(scheduled fall semesters of even numbered calendar years)*: Investigation of the relationship between the movement of water through a porous medium and the movement of inorganic and organic compounds. Special emphasis is given to developing methods by which contaminant movement can be predicted.
- **GEOL 5366 - Advanced Topics in Geology** *(scheduled as needed)*: In-depth study of the following subjects: (a) sedimentary environments, (b) advanced field geology, (c) quantitative applications, and (d) advanced petrology. Students may receive credit for each of the above topics.
- **GEOL 5368 - Special Studies in Geology** *(scheduled as needed)*: Study of general and specific topics in geology. Content changes with each offering. Note: Class may be repeated once under a different topic.
- **GEOL 5375 - Advanced Graduate Studies** *(scheduled as needed)*: Individual studies; topics of study are especially designed to increase the student's knowledge of some aspects of geology as related to his/her field of interest. Note: Class may be repeated under different topics.
- **GEOL 5388 – Non-Thesis Research** *(scheduled as needed)*: Graduate research. Should be planned and initiated at least one semester before the research is to be completed.
- **GEOL 5389 - Thesis Research** *(scheduled as needed)*: Graduate research. Should be planned and initiated at least two semesters before the research is to be completed. Note: Students completing a thesis must register each semester university resources are being utilized.
- **GEOL 5390 - Thesis Writing** *(scheduled as needed)*: Writing of thesis. The research project of this course must be initiated at least one semester before registration in order that the thesis research be carried out during a period of not less than two semesters. Note: Students completing a thesis must register each semester university resources are being utilized.